THE ECONOMIC IMPACT OF AGRICULTURE AND FORESTRY ON THE COMMONWEALTH OF VIRGINIA: THE STUDY IN BRIEF

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STUDY HIGHLIGHTS

AGRICULTURE AND FORESTRY

• The total economic impact of agriculture and forestry-related industries in Virginia was almost $79 billion in total industry output in 2006, the base year for this study. The total employment impact is approximately 501,500 jobs, which makes up 10.3 percent of state employment.

• Every job created in agriculture and forestry related industries results in another 1.5 jobs in the Virginia economy. Every dollar generated in value-added results in another $1.75 value-added in the Virginia economy.

• The impacts of agriculture and forestry are felt in other sectors of the economy. The largest effects are in the directly affected manufacturing and agriculture, forestry, fishing, and hunting industries. However, agriculture and forestry stimulate large public and private services responses through the effects of industry purchases and subsequent rounds of indirect and induced spending. The effects reverberate throughout the economy affecting every sector.

• There are notable regional differences in the sizes of agriculture and forestry related industries. The largest direct employment impact is in Northern Virginia (which in this case is defined to include the northern parts of the Shenandoah Valley as well as the more metropolitan areas around Washington, D.C.), and the largest total impact is observed in Central Virginia. Impacts as a percentage of estimated total employment range from a low of approximately 5 percent of total employment in Northern Virginia to nearly one in four employees in the Southern district centered on Danville, which is heavily dependent on forest products industries.

• Although this study did not examine the full effects of agritourism and forest-related recreation, such as wildlife recreation, horse events, wine tourism, and agricultural festivals, results from other Virginia studies suggest that the impacts on output may amount to several billions of dollars.

• Agriculture and forestry activities have significant societal and ecological effects in addition to their economic benefits. Forests provide benefits in the form of carbon sequestration, wildlife habitat and biodiversity, flood mitigation and improved water quality. Rural scenic amenities may also improve quality of life.

• The impact results provided in this study are not comparable to previously published results based on earlier studies because of differences in agriculture and forestry-related sector definitions, input data, and model characteristics.

AGRICULTURE

• The total impact of agriculture-related industries was over $55 billion in total industry output and approximately 357,100 jobs.

FORESTRY

• The forestry sector had a total impact of over $23 billion in total industry output and approximately 144,400 jobs.

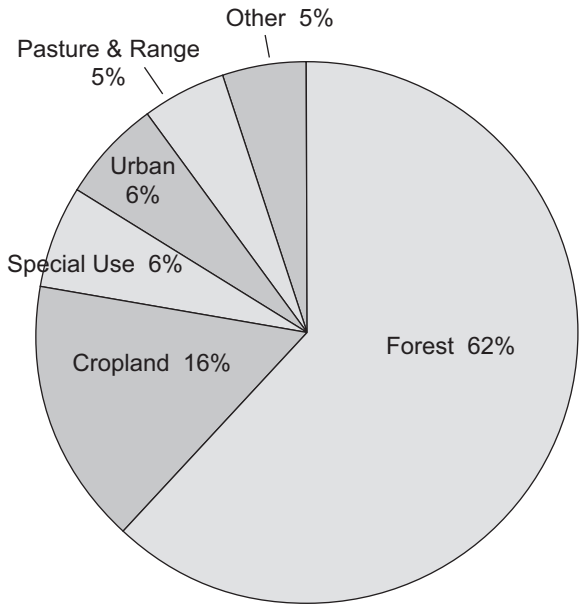
THE ECONOMIC IMPACT OF AGRICULTURE AND FORESTRY ON THE COMMONWEALTH OF VIRGINIA: THE STUDY IN BRIEF[1]

INTRODUCTION

Since the founding of the Jamestown colony in 1607, agriculture and forestry activities have been key components of the Virginia economy. Their importance is still highly visible today. Nearly 21 million acres, or 82 percent of the commonwealth's total land area is forest, cropland, or pasture and range (**Figure 1**). Additional land is forested parkland and public open space. In 2006, Virginia's farms generated an estimated $2.7 billion in cash receipts, and forest landowners received nearly $350 million for harvested timber. More importantly, the sectors have strong linkages with other industries in Virginia that add value throughout the value chain, including processing and distribution industries. Many of these industries would not exist in the state in their current form without strong regional agriculture and forest raw materials. These sectors purchase from other industries that in turn purchase from other industries in a cascading series of transactions that creates a stimulating effect across the economic spectrum. In addition, agriculture-related and forestry-related employment supports the expenditures of households that circulate throughout the economy creating additional earnings and employment.

As will be shown, when these effects are counted, the total economic impact of agriculture and forestry-related industries in Virginia was $79 billion in total industry output in 2006. The value-added impact was $37 billion, which constitutes approximately 9.9 percent of Virginia gross domestic product (GDP). The total employment impact was approximately 501,500 jobs, which made up 10.3 percent of state employment.

Figure 1 Virginia Land Use Summary by Major Category, 2002



Source: Lubowski et al. (2006)

VIRGINIA'S AGRICULTURE AND FORESTRY INDUSTRIES

AGRICULTURE

Virginia has a rich and varied agriculture economy. It plays a prominent role in several national commodity markets, ranking third for fresh tomatoes and fifth in tobacco (**Table 1**). Apples, potatoes, snap beans, broilers, and turkeys are other significant commodities. In terms of cash receipts, nearly three-fifths is derived from livestock and poultry (**Figure 2**). Field crops account for 15 percent of total cash receipts.

Although Virginia employment has continued to decline, productivity improvements, attributable to increased mechanization and the adoption of new technologies, have meant that output has actually increased over 1990-2006. The

1 Rephann, Terance. 2008. *The economic impact of agriculture and forestry on the Commonwealth of Virginia*. Charlottesville, VA: Weldon Cooper Center for Public Service, University of Virginia.

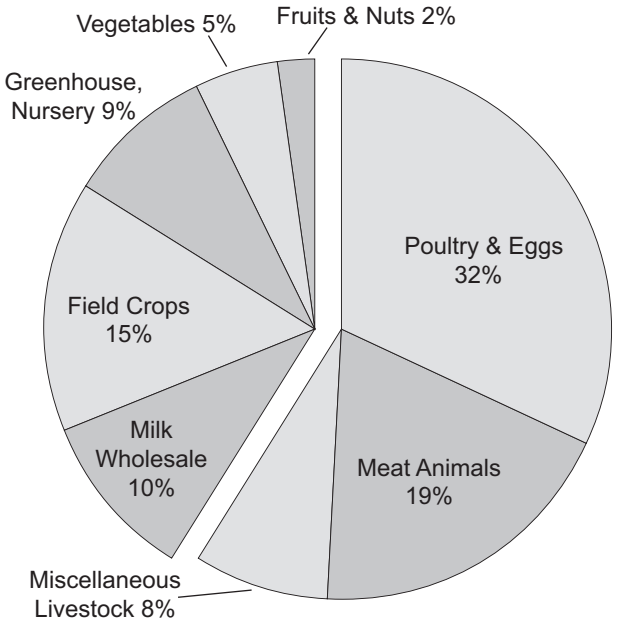
TABLE 1: VIRGINIA'S TOP 10 COMMODITIES IN U.S. MARKET, 2006

Commodity	National Rank	Percentage of U.S. Production
Tomatoes, Fresh Market	3	6.06
Tobacco	5	6.42
Apples	6	2.18
Potatoes, Summer	6	8.24
Beans, Snap, Fresh Market	7	4.16
Turkeys	8	8.21
Peanuts	8	1.43
Grapes	8	0.09
Sweet Potatoes	9	0.30
Broilers	10	2.88

Source: U.S. Department of Agriculture, Economic Research Service (2007)

composition of this output, however, has been in continuous flux. Decreases in output of several farm products such as peanuts, tobacco, dairy, and hogs have been offset by gains in other areas such as poultry, equine, aquaculture, cotton, and greenhouse and nursery products.

Figure 2 Cash Receipts by Commodity, Virginia, 2006



Source: U.S. Department of Agriculture, Economic Research Service (2007)

Farm production shows strong geographical patterns in Virginia. Farm employment as a share of total employment is greatest in southwestern and southern parts of the state. However, the picture is more complex and differentiated than that simple snapshot. Virginia's agriculture sector shows substantial regional diversity because of strong regional specializations by farm commodity. For instance, cotton is primarily a southeastern crop. Over three-quarters of tobacco production can be found in the southern and southwestern regions. Half of poultry production occurs in the northern region. Vegetable production is concentrated in the east, while fruit production shows a more northern pattern.

FORESTRY

Virginia's forests are also quite diverse. Although the commonwealth's forests are dominated by hardwood stands, softwoods are more common removal species in the southeast and coastal regions. Oak-hickory is the dominant forest type followed by loblolly-shortleaf, and oak-pine (**Figure 3**). Virginia's forest resources are distributed throughout the state. Less forested areas are found in the Washington, DC environs and the eastern shore, while more forested areas exist in the west and south. The commonwealth's timber inventory is growing, and this growth is expected to continue into the near future. However, the long-term outlook is more uncertain because of urbanization pressures, environmental changes, disease, pests, and forest management problems that arise from new property ownership patterns and fragmentation of larger tracts into smaller parcels.

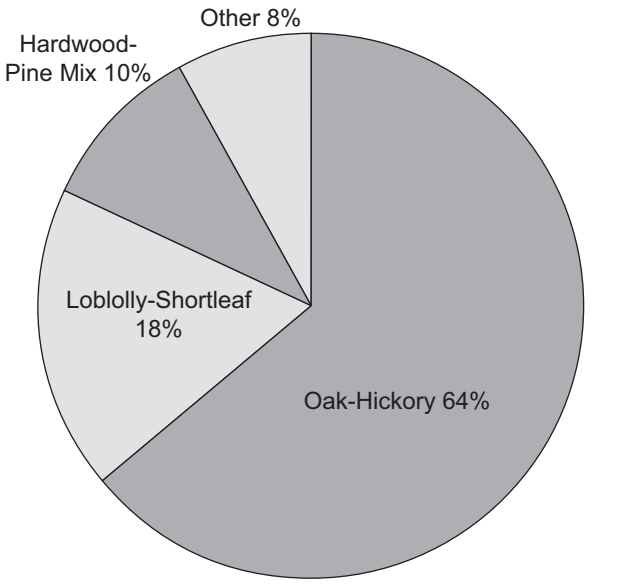
Forest stumpage and production volume have remained fairly steady over the last ten years after a period of significant growth during the late 1980s and throughout the 1990s. Virginia produced an estimated 503 million cubic feet of roundwood timber products in 2005. Approximately 45

percent of this was saw logs, another 40 percent pulpwood, and the remainder composite panels, veneer logs, and other industrial products such as poles, posts, and mulch. Virginia mills produced 1.6 billion board-feet of lumber in 2006, including nearly eight percent of the hardwood lumber in the nation making the state the third largest producer in this category after Pennsylvania and Tennessee.

GAUGING THE DIRECTION OF AGRICULTURE AND FORESTRY INDUSTRIES

Although the agriculture and forestry sectors have had fairly steady production in recent years, both sectors face opportunities and challenges in the process of maintaining either their absolute or relative positions within the economy. These positions will be shaped by numerous factors in the areas of production technology, consumer demand, energy, urban population growth, government policy, and the global economy. By measuring the impact of the forestry and agriculture sectors now it may be possible to benchmark and gauge in the future how these sectors are evolving as part of Virginia's economy.

Figure 3 Virginia Land Area by Forest Type, 2005



Source: Virginia Department of Forestry (2007)

METHODOLOGY OF STUDY

INPUT-OUTPUT ANALYSIS

This study uses the standard tools of input-output analysis to estimate the contribution of the agriculture and forestry industries to Virginia's economy and employment. Input-output analysis provides a way to estimate the effect of agriculture and forestry related sales and employment on total state economic output and employment. The methodology estimates the "indirect" and "induced" effects of agriculture and forestry sales. The two effects occur when money retained in the state circulates through the economy. For instance, businesses providing inputs such as supplies and services to agricultural and forestry industries must purchase inputs in order to produce the product or service, and so forth. These effects are referred to as "indirect impacts." Also, the spending of new household income attributable to the direct and indirect effects of agriculture and forestry will induce subsequent rounds of spending. These effects are called "induced impacts." The incremental effect of each round of spending dissipates because a portion of the spending leaks out of the economy into another region.

THE IMPLAN MODEL

This study uses the IMPLAN (which stands for IMpact analysis for PLANning) input-output model. It has been used extensively in regional impact analysis to measure the economic effects of various kinds of events and public policies such as plant closures, the construction of sports stadiums, and energy policies. In addition, it has been used in many studies of the economic impact of the forestry and agriculture industries, including impact studies for Virginia agriculture conducted in the mid 1990s by Virginia Tech. However, there are important differences that make it impossible to compare their impact esti-

mates to the results of this study. The industries included in the analysis differ, alternative input data is used, and the IMPLAN model itself has changed.

MEASURES OF ECONOMIC ACTIVITY

Economic impacts are evaluated using three different measures: total industrial output, employment, and value-added. Total industrial output represents the total value of industry output during the period. Employment includes both full-time and part-time jobs. Value-added refers to the additional value created or "added" to products at different stages of production.

INDUSTRIES INCLUDED IN ANALYSIS

In this analysis, industrial categories were defined based on their degree of dependency on Virginia agricultural and forestry raw materials. Industries for both forestry and agriculture were divided into "production," "core processing," "extended processing," and "distribution" activities. "Production" activities are those industries associated with growing and harvesting basic farm, commodities timber, and non-timber commodities. "Core processing" activities are manufacturing industries that are heavily dependent on state commodities for production with strong linkages with local farming and forestry. It is unlikely that these industries would exist within the state in anything like their current form if commodity production did not occur in the state. An example of such an industry is milling lumber which is highly dependent on nearby timber. "Extended processing" activities are manufacturing industries that are somewhat less dependent on Virginia farm and forest commodity inputs. An example of this type of industry is soft drink manufacturing which relies primarily on imported syrups and concentrates. "Distribution" activities consist of selected warehousing and wholesaling industries as well as landscaping services that are closely related to agriculture and forestry product distribution. Lastly, the study makes impact estimates for agricultural support payments to Virginia's farmers from the federal government.

RESULTS

DIRECT IMPACTS

In 2006, the direct effect of Virginia agriculture-related and forest-related industries generated $42 billion in total output, approximately 196,100 employees, and over $13 billion in value-added (**Table 2**). Agriculture production was the largest component in terms of employment. Agriculture extended processing accounts for over 40 percent of total output and value-added.

TOTAL IMPACTS

The total economic impact (including direct, indirect, and induced effects) of agriculture-related and forestry-related industries in Virginia was $79 billion in total industry output or sales in 2006 (**Table 3**). The value-added impact was $37 billion dollars, which constitutes approximately 9.9 percent of Virginia gross domestic product (GDP). The total employment impact is 501,000 employees, which makes up 10.3 percent of state employment (**Figure 4**).

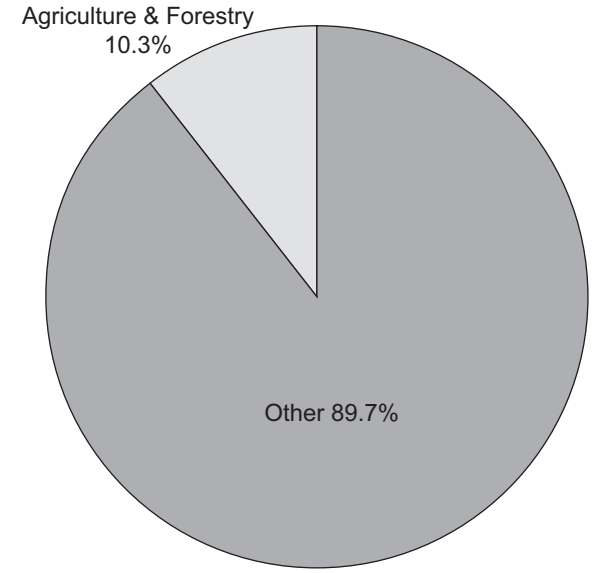
TOTAL IMPACTS BY INDUSTRY

The impacts of agriculture and forestry were felt in other sectors of the economy. The largest effects were in the manufacturing and agriculture, forestry, fishing, and hunting industries where direct effects were dominant. However, agriculture and forestry stimulated large public and private services responses through the effects of industry purchases and subsequent rounds of indirect and induced spending. The effects reverberated throughout the economy affecting every sector. For some industries, such as transportation and warehousing, the impacts are primarily indirect. For others, such as construction, retail trade, health and social services, and government, the impacts are chiefly induced. The impacts were estimated by farm

Table 2 Virginia Agriculture and Forestry Industries Direct Output, Employment, and Value Added, 2006

Implan Industry	Output (Millions $)	Employment	Value Added (Millions $)
Agriculture			
Production	2,890.9	55,085	1,333.1
Core processing	6,954.4	21,755	1090.7
Extended processing	17,472.1	27,550	5661.8
Distribution	1,443.1	26,648	761.3
Government Payments	176.6	4,808	120.9
Forestry			
Production	1,601.4	6,931	464.1
Core processing	6,108.1	21,479	1,777.9
Extended processing	4,854.1	27,309	1,585.2
Distribution	757.8	4,528	516.9
Total	42,258.6	196,093	13,311.9

Figure 4 Virginia Agriculture and Forestry Employment Impact as a Percentage of Total Employment, 2006



and forestry sectors and further broken down into their production, core processing, extended processing, distribution, and government payments components.

Table 4 and **Table 5** break down the direct, indirect, induced, and total impacts separately for the agriculture and forestry sectors. The agriculture sector accounted for $55 billion in total industry output, approximately 357,100 jobs, and nearly $26 billion in value-added. The forestry sector had a total impact of approximately $23 billion in total industry output, approximately 144,400 jobs, and nearly $11 billion in value-added. The multipliers associated with agriculture were slightly larger than those for forestry.

Results indicate that agriculture-related activities account for approximately 70 percent of total output, employment and value-added impacts

TABLE 3: VIRGINIA TOTAL, DIRECT, INDIRECT, AND INDUCED IMPACTS OF AGRICULTURE AND FORESTRY, 2006.

	Output (million $)	Employment	Value Added (million $)
Direct	42,258.6	196,093	13,311.9
Indirect	11,817.2	74,970	6,868.7
Induced	24,526.4	230,420	16,373.0
Total	78,602.2	501,485	36,553.5

TABLE 4 VIRGINIA TOTAL, DIRECT, INDIRECT, AND INDUCED IMPACTS OF AGRICULTURE, 2006.

	Output (million $)	Employment	Value Added (million $)
Direct	28,937.1	135,846	8,967.7
Indirect	8,859.1	56,603	5,212.4
Induced	17,377.9	164,656	11,639.7
Total	55,174.1	357,105	25,819.9
Multiplier	1.91	2.63	2.88

TABLE 5 VIRGINIA TOTAL, DIRECT, INDIRECT, AND INDUCED IMPACTS OF FORESTRY, 2006.

	Output (million $)	Employment	Value Added (million $)
Direct	13,321.5	60,247	4,344.1
Indirect	2,958.1	18,367	1,656.3
Induced	7,148.6	65,766	4,733.3
Total	23,428.2	144,380	10,733.7
Multiplier	1.76	2.40	2.47

with forestry related activities making up the remainder. In terms of total impacts relative to total state employment and GDP impacts, agriculture related industry represents approximately 7 percent of employment and 7 percent of GDP. Forestry-related industry represents approximately 3 percent of statewide totals.

Looking at components along the agriculture and forestry value chain (**Figure 5**), production industry impacts make up 17 percent of the total employment impact but a considerably smaller share, 10 percent, of value-added and output impacts. Core processing makes up 23 percent of the employment and value-added impacts but 27 percent of output impact. Extended processing is the largest impact category, constituting 47 percent of employment impact, 56 percent of output impact, and 58 percent of value-added impact. Distribution activities account for 11 percent of employment impact, 8 percent of value-added impact, and 6 percent of output impact. Government payments account for approximately 1 percent of each. Therefore, the bulk of the total impacts is connected to agribusiness processing and distribution activities with a somewhat weaker reliance on Virginia farm commodities and timber.

TOTAL IMPACTS BY REGION

Impacts were estimated for each of seven National Agricultural Statistical Service (NASS) agricultural statistic districts located in Virginia (**Figure 6**). There are notable regional differences in the absolute and relative sizes of agriculture and forestry related industries. The largest direct employment impact is in the Northern district and the largest total impact is observed in the Central district (**Table 6**). Impacts as a percentage of estimated total employment range from a low of approximately 5 percent of total employment in Northern Virginia to nearly one in four employees in the Southern district centered on Danville, which is heavily dependent on forest products industries.

LIMITATIONS OF STUDY

Since the study is an economic impact study, no attempt is made to gauge the wider social benefits and costs of agriculture and forestry. Agriculture and forestry have tangible societal and ecological effects. Forests, in particular, provide benefits in the form of carbon sequestration, stabilization of soils, wildlife habitat and biodiversity, flood mitigation and improved water quality. Rural scenic amenities may also improve

Figure 5 Virginia Total Impacts by Agriculture and Forestry Component, 2006

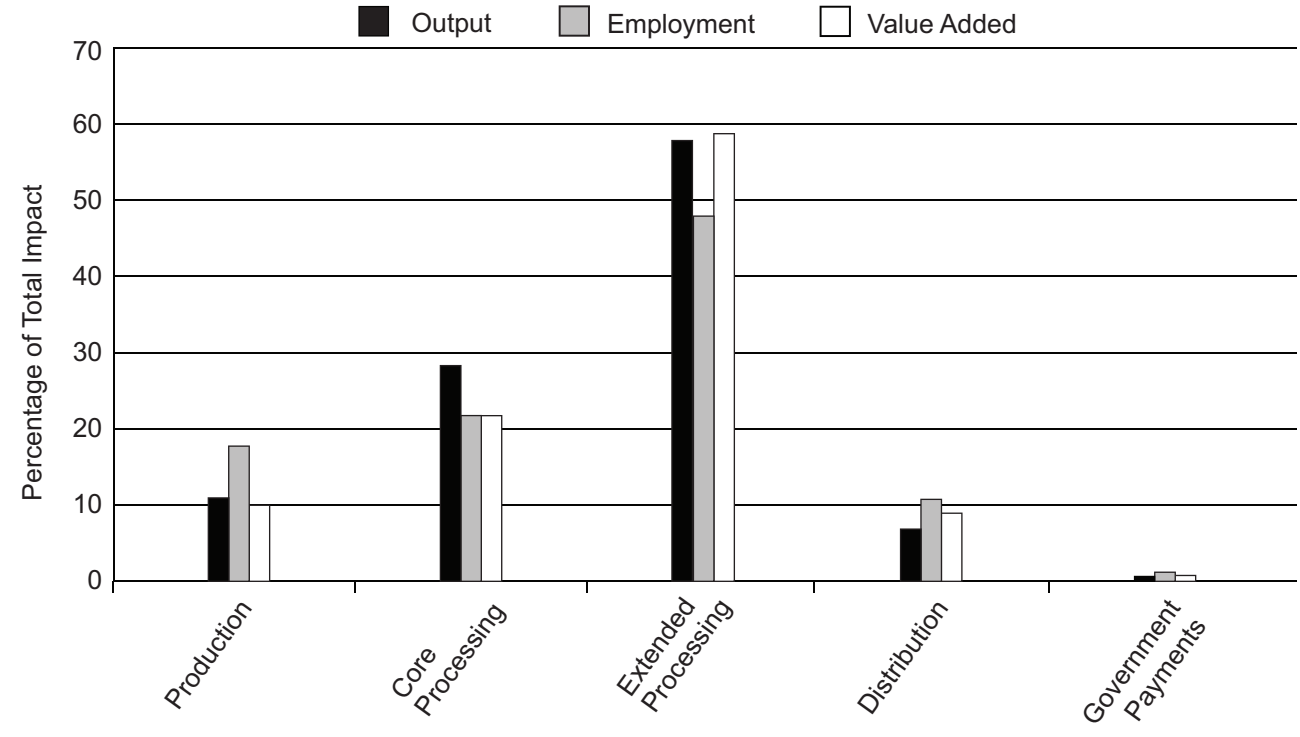
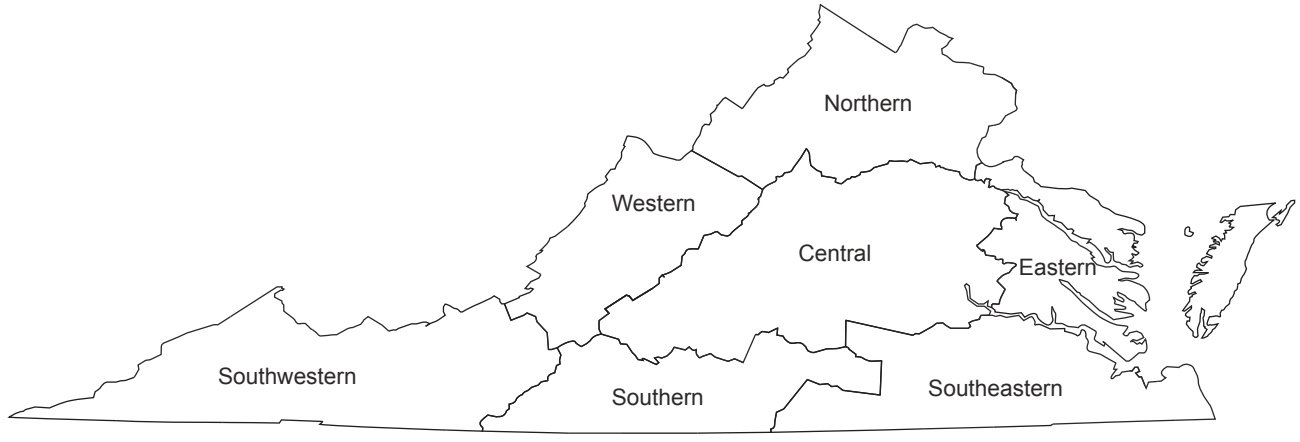


Figure 6 Virginia Agriculture Statistic Districts



Source: National Agricultural Statistics Service

TABLE 6 TOTAL IMPACT OF VIRGINIA AGRICULTURE AND FORESTRY BY DISTRICT, 2006

	Output (million $)	Employment	Value Added (million $)
Northern	11,874.2	93,539	5,596.2
Eastern	5,694.9	38,595	2,450.1
Western	6,342.3	37,768	2,519.8
Southern	5,346.2	36,620	2,051.4
Southwestern	3,952.6	32,627	1,410.6
Central	31,603.0	183,576	15,446.8
Southeastern	9,367.2	61,596	3,892.3
Intra-state	4,421.8	17,164	3,186.2
Total	78,602.2	501,484	36,553.5

quality of life. Improper agricultural and logging practices, on the other hand, can impose costs arising from water quality degradation, noxious odors, and airborne pathogens.

Moreover, many forestry and agriculture impacts are not captured by the estimates in this study. For example, recreation and tourism impacts are not fully reflected in the impacts because of the difficulty of measuring all consumer expenditures associated with agritourism and forest recreation. For instance, the effects of Virginia agricultural commodities sold in wineries and on farms is captured in this analysis. However, tourist spending on transportation, lodging, and other products and services is not. Some estimates of the recreation and tourism contribution of agriculture and forestry (e.g., wineries, freshwater fishing, hunting, horse shows) available from other studies suggest that these additional impacts may amount to billions of dollars.